

## ADHD PHENOTYPE ALGORITHM

**Background:** Attention deficit-hyperactivity disorder (ADHD) is a complex neuropsychiatric disorder, with an estimated prevalence of 7% of school-age children and a smaller percentage (~4%) of adults. Three subtypes include predominantly inattentive, predominantly hyperactive-impulsive, and combined hyperactive-inattentive. In ICD-9 and ICD-10, ADHD is listed with hyperkinetic disorder/hyperkinetic syndrome (HKD).

**Cases:** Cases must be 4 years of age or older, and are defined by a diagnostic history of ADHD/HKD as determined by ICD9 codes and/or a history of ADHD medications.

Case inclusion criteria:

1a) Individual is 1460 days-old or older

*plus*

1b) Individual's medical record includes a relevant ICD9 code (see **Table 1**) in one or more in-person visits, on separate calendar days

*plus*

1c) Individual's medical record includes one or more prescriptions of ADHD-related medications (see **Table 2**)

*or*

2a) Individual is 1460 days-old or older

*plus*

2b) Individual's medical record includes a relevant ICD9 code (see **Table 1**) in two or more in-person visits, on separate calendar days.

Case exclusion criteria:

Individual's medical record includes one or more of the ICD9 codes shown in **Table 3**.

**Controls:** Controls must be 4 years of age, or older. Exclusionary criteria for controls include psychiatric, neurological and related disorders as defined by ICD9 codes or patient chart. Additionally, controls are excluded if his/her medical record includes a medication used to treat psychiatric, neurological and related disorders.

Control inclusion criterion:

1) Individual is 1460 days-old or older.

2) Individual must have two or more visits in the last five years (of last day in record)

Control exclusion criteria:

1) Individual's medical record includes one or more prescriptions for a medication addressing psychiatric, neurological or related disorders (see **Table 4**)

*and/or*

2) Individual's medical record includes one or more ICD9 codes addressing psychiatric, neurological or related disorders (see **Table 5**)

*and/or*

3) Individual's patient chart includes one or mentions of an ADHD or hyperkinesias (see **Table 1**).

**Covariates:** Relevant covariates are: 1) age, 2) gender, 3) ethnicity, race, and 4) birth month (younger children can be more hyperactive in the classroom, which may be mis-diagnosed as ADHD) Ref: Elder Todd. The Importance of Relative standards in ADHD Diagnoses: Evidence Based on Exact Birth Dates. J. Health Economy. Sept 2010;29(5):641-656).

ICD-9 Code	Diagnosis
<b>314</b>	Hyperkinetic syndrome of childhood
<b>314.0</b>	Attention deficit disorder
<b>314.01</b>	With hyperactivity
<b>314.1</b>	Hyperkinesis with developmental delay, Developmental disorder of hyperkinesis
<b>314.2</b>	Hyperkinetic conduct disorder
<b>314.8</b>	Other specified manifestations of hyperkinetic syndrome
<b>314.9</b>	Unspecified hyperkinetic syndrome

Stimulants	Non-Stimulants	Other Drugs	Other Drugs
Methylphenidate	Norepinephrine reuptake inhibitor	NDRI	Imipramine
Attenta	NRI	Amfebutamone	Melipramine
Concerta	Atomoxetine	Aplenzin	Tofranil
Daytrana	Attentin	Bupropion	Lithium
Desoxyn	Strattera	Elontril	Eskalith
Hynidate	Tomoxetine	Prexaton	Lithobid
Metadate		Voxra	Olanzapine
Methylin		Wellbutrin	Zyprexa
Methylin	<b>Alpha-2 Agonists</b>	Zyban	Paroxetine
Rilatine	Clonidine	SNRI's (Tricyclics)	Aropax
Ritalin	Guanfacine	Imipramine	Brisdelle
Dexmethylphenidate		Melipramine	Paxil
Attenade		Tofranil	Pexeva
Celgene		Carbamazepine	Sereupin
Focalin		Equetro	Seroxat
Amphetamine		Tegretol	Pemoline
Adderall		Clonazepam	Betanamin
Dexedrine		Clonex	Ceractiv
DextroStat		Klonopin	Cylert
Prodrug Amphetamines		Kriadex	Tradon
Lisdexamfetamine (Vyvanse)		Linotril	Risperidone
		Paxam	Risperdal
		Petril	Sertraline
		Ravotril	Altruline
		Rivatril	Besitran
		Rivotril	Daxid
		Divalproex	Deprax
		Depakote	Eleval
		Epilim	Emergen

		Fluoxetine	Gladem
		Fontex	Implicane
		Prozac	Lowfin
		Sarafem	Lustral
		Hydroxyzine	Sealdin
		Alamon	Sedoran
		Atarax	Serivo
		Aterax	Sertralin
		Durrax	Stimuloton
		Equipose	Tresleen
		Orgatrac	Zoloft
		Masmoran	Trazodone
		Paxistil	Beneficat
		Quiess	Deprax
		Tran-Q	Desirel
		Tranquizine	Desyrel
		Vistaril	Mesyrel
			Molipaxin
			Oleptro
			Thombran
			Trazorel
			Trialodine
			Trittico

<b>Table 3, ADHD Cases: Exclusionary ICD9 Codes.</b>	
<b>Psychiatric and Related</b>	
<b>ICD-9 Codes</b>	<b>Diagnosis</b>
290	Dementias
294	Persistent mental disorders due to conditions classified elsewhere-
300.8x	Somatoform disorders
301.51	Chronic factitious illness with physical symptoms
307.3x	Stereotypic movement disorder
317-317.x	Mild mental retardation
318-318.x	Other specified mental retardation
319-319.x	Unspecified mental retardation
<b>General</b>	
<b>ICD-9 Codes</b>	<b>Diagnosis</b>
006.5	Amebic brain abscess
013.2	Tuberculoma of brain
191-191.x	Malignant neoplasm of brain
192-192.x	Malignant neoplasm of other and unspecified parts of nervous system
237.7x	Neurofibromatosis
290.1	Presenile dementia
348.1	Anoxic brain damage
348.2	Benign intracranial hypertension
348.3	Encephalopathy, not elsewhere classified
348.4	Compression of brain

348.5	Cerebral edema
348.8	Other conditions of brain
348.9	Unspecified condition of brain
437.2	Hypertensive encephalopathy
742-742.x	Other congenital anomalies of nervous system
764-764.x	Slow fetal growth and fetal malnutrition
767.0	Subdural and cerebral hemorrhage
767.9	Birth trauma, unspecified
800-804	Fracture of skull
959.01	Head injury, unspecified

**Table 4, ADHD Controls: Exclusionary medications by sub-type.**

Stimulants	Non-Stimulants	Other Drugs	Other Drugs
Methylphenidate	Norepinephrine reuptake inhibitor	SNRI's (Tricyclics)	Imipramine
Attenta	NRI	Imipramine	Melipramine
Concerta	Atomoxetine	Melipramine	Tofranil
Daytrana	Attentin	Tofranil	Lithium
Desoxyn	Strattera	Carbamazepine	Eskalith
Hynidate	Tomoxetin	Equetro	Lithobid
Metadate		Tegretol	Olanzapine
Methylin		Clonazepam	Zyprexa
Methylin		Clonex	Paroxetine
Rilatine		Klonopin	Aropax
Ritalin		Kriadex	Brisdelle
Dexmethylphenidate		Linotril	Paxil
Attenade		Paxam	Pexeva
Celgene		Petril	Sereupin
Focalin		Ravotril	Seroxat
Amphetamine		Rivatril	Pemoline
Adderall		Rivotril	Betanamin
Dexedrine		Divalproex	Ceractiv
DextroStat		Depakote	Cylert
Prodrug Amphetamines		Epilim	Tradon
Lisdexamfetamine (Vyvanse)		Fluoxetine	Risperidone
		Fontex	Risperdal
		Prozac	Sertraline
		Sarafem	Altruline
		Hydroxyzine	Besitran
		Alamon	Daxid
		Atarax	Deprax
		Aterax	Eleva
		Durrax	Emergen
		Equipose	Gladem
		Orgatraz	Implicane
		Masmoran	Lowfin
		Paxistil	Lustral
		Quiess	Sealdin

		Tran-Q	Sedoran
		Tranquizine	Serivo
		Vistaril	Sertralin
			Stimuloton
			Tresleen
			Zoloft
			Trazodone
			Beneficat
			Deprax
			Desirel
			Desyrel
			Mesyrel
			Molipaxin
			Oleptro
			Thombran
			Trazorel
			Trialodine
			Trittico

<b>ICD-9 Codes</b>	<b>Diagnosis</b>
006.5	Amebic brain abscess
013.2	Tuberculoma of brain
191-191.x	Malignant neoplasm of brain
192-192.x	Malignant neoplasm of other and unspecified parts of nervous system
237.7x	Neurofibromatosis
290-319.x	Mental disorders
327-327.x	Organic sleep disorders
330-337.x	Hereditary and degenerative diseases of the central nervous system
342-342.x	Hemiplegia and hemiparesis
343-343.x	Infantile cerebral palsy
344-344.x	Other paralytic syndromes
345-345.x	Epilepsy and recurrent seizures
347-347.x	Cataplexy and narcolepsy
348-348.x	Other conditions of brain
349-349.x	Other and unspecified disorders of the nervous system
437.2	Hypertensive encephalopathy
742-742.x	Other congenital anomalies of nervous system
758.x	Chromosomal anomalies
764-764.x	Slow fetal growth and fetal malnutrition
765-765.x	Disorders relating to short gestation and low birthweight
767.0	Subdural and cerebral hemorrhage
767.9	Birth trauma, unspecified
779.4	Drug reactions and intoxications specific to newborn
779.5	Drug withdrawal syndrome in newborn
781-781.x	Symptoms involving nervous and musculoskeletal systems
800-804	Fracture of skull
959.01	Head injury, unspecified
996.2	Mechanical complication of nervous system device, implant, and graft